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PREREQUISITES GOVERNING THE APPLICATION OF NUCLEAR POWER IN AERIAL BOMBS

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Tactico-Technical Prerequisites and Premises

There exists a definite upper limit of dimensions and weight for bombs, as determined by conditions of transport, particularly the carrying capacity and construction of bombers.

For the solution of many military problems, as indicated by experience, bombs will be constructed whose weights conform to the above-mentioned limitations. The English are paying particular attention to such matters as weight limitation of bombs. In 1945, the weight of the heaviest English bomb reached 11 tons. We can assume that still heavier bombs will make their appearance as the weight-carrying capacity of planes continues to increase in the future.

The increase in the weights of bombs is not mere chance, but is determined by the following conditions:

1. Great charges are required for more complete and accurate destruction of many targets because targets with massive steel-reinforced concrete or steel frames, as indicated by experience, are destroyed by 10-ton bombs barely within the limits of a radius of about 25 meters. Moreover, there exist steel and reinforced-concrete objectives which, in their dimensions, exceed by far this very limiting radius of destruction. Therefore, heavier bombs are necessary.

2. During sight bombing, for the purpose of certain destruction of the target, it is necessary that the sum of the effective radius of the target and the radius of destruction exceed the probable deviation of the point of impact from the center of the target. Since accurate sight bombing is effected with

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difficulty and the probable deviation or scatter is generally significant, then in order to destroy the target it is necessary to have bombs with considerable radius of destruction. In many cases, therefore, there is needed a radius of destruction such as cannot be secured by the heaviest present-day bombs; hence further increases in the caliber of bombs are required.

3. In destroying surface areas by explosive effects, namely by brisance, it is also expedient in many cases to employ bombs of considerable caliber. According to certain theoretical considerations it is possible also to show quantitatively that increasing the caliber of bombs is, in general, expedient.

4. In certain special cases, individual objectives prove to be so well protected that they cannot be destroyed by the heaviest of present-day bombs. Here it is necessary to note first of all underground objectives, reaching a depth of 30 meters or more. Further, we can note the super-heavy, steel-reinforced concrete underground and aboveground constructions with roofs of reinforced concrete 7 meters thick and with a continuous massive steel anti-piercing covering (for example, KP, the new incomplete project of the German General Staff). In order to destroy such special objectives, bombs of larger dimensions than exist at the present time are necessary.

But, as was already shown, the magnitude of dimensions and weight of bombs is limited, as determined by the construction of aircraft, and cannot be increased beyond tactically necessary dimensions. Therefore, there is need for an explosive which would possess tremendously higher energy per unit mass of charge. But the chemistry of explosives still cannot guarantee any essential increase in the energy of a unit mass of charge. Theoretically it can be shown generally that chemical energy, which is concentrated in the superficial layers of the electronic envelopes of molecules, cannot essentially exceed the limits attainable in practice today. Thus, it is necessary to find a form of explosive absolutely new in principle.

From the point of view of maximum concentration of energy, it is necessary to consider first of all the atomic nuclei of certain isotopes. The quantity of energy which can be released during transformations of isotopes exceeds by several tens of millions of times the energy of ordinary explosives.

Finally, to recover this substance in sufficient amounts necessary for this purpose is exceptionally expensive and complicated. Therefore the energy of atomic nuclei, if concentrated, can have value only in exceptional cases where the importance of maximum concentration of explosive energy localized in one critical spot overcomes economic factors.

The concentration of energy in atomic nuclei is so large that its utilization for military purposes can give qualitatively new tactical, operative, and also strategic results. Particularly, it is sufficient for one bomber to convey a considerable distance several bombs (with charges containing the energy of atomic nuclei in a form capable of explosion) in order to annihilate the most powerful constructions in the territory in several square kilometers and to a depth of 50 to 100 meters within the earth. The considerable radius of destruction of each bomb of such a type (of several kilometers) permits reduction of accuracy requirements of normal bombing so that a bomb can be dropped from great heights or flown in weather requiring instrument flying.

The area of total destruction of the atomic bomb dropped by the US on Hiroshima was about 10 square kilometers; the second bomb, dropped on Nagasaki, had a destructive area of about 5 square kilometers.

The tendency for bombs to become more and more powerful is a matter of record. It is very probable that, in the event of a new large-scale war in the future, atomic bombs will be employed on a very large scale. Hence it is

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obviously necessary to study the theoretical and practical properties of this new form of bombing weapon with special attention.

Probable Construction of the Atomic Bomb

On the basis of the Smyth Report and material from the September 1945 issue of Electronics, it is possible to assume that the basic part of the atomic bomb is a cannon, or gun, disposed along the axis of the bomb, in the barrel of which there are placed, at a considerable distance apart, the halves of a critical charge of uranium U-235 or plutonium. In the lower part of the bomb, apparently, there is placed a "radio igniter" which actuates a charge when the bomb approaches within a given distance of the surface of the earth. The radio igniter ignites an auxiliary (booster) powder charge. This charge hurls upward the lower half of the critical charge of uranium U-235 or plutonium like a projectile. This half collides in the upper end of the cannon's barrel with the other half of the critical charge (so-called "target"). Upon union of the two halves in the form of a compact mass, the action of the neutrons within the uranium or plutonium causes the rapid disintegration of the atomic nuclei, giving practically instantaneous release of the energy in the atomic nuclei of uranium U-235 or plutonium.

This described system is located within a massive block, possibly lead, which checks the very rapid expansion of the charge during explosion and which guarantees thus the most complete decomposition of the total critical mass.

In order that the aircraft dropping such a bomb may not be harmed by its explosion, it must go a sufficient distance from the site of explosion. This can be made possible by a sufficiently slow fall of the atomic bomb (since it will explode while still in the process of falling), by use of a parachute.

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